

# THE GENUS *MYRMICA* LATR. (HYMENOPTERA, FORMICIDAE) IN POLAND – A SURVEY OF SPECIES AND A KEY FOR THEIR IDENTIFICATION

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**Abstract.**— The paper contains a taxonomic review of 13 species of the genus *Myrmica* Latr. occurring in Poland with information on their geographical ranges, distribution in Poland and biology. The following species are under discussion: *M. rubra* (L.), *M. ruginodis* Nyl., *M. sulcinodis* Nyl., *M. lobicornis* Nyl., *M. rugulosa* Nyl., *M. gallieni* Bondr., *M. hellenica* For., *M. speciosoides* Bondr., *M. scabrinodis* Nyl., *M. sabuleti* Mein., *M. lonae* Finzi, *M. hirsuta* Elmes and *M. schenckii* Viereck. A key for identifying them on the basis of workers and males is included.



**Key words.**— ants, *Myrmica*, taxonomy, zoogeography, biology, fauna, Poland, catalogue, key

## INTRODUCTION

The genus *Myrmica* Latreille, 1805 (the tribe Myrmicini, the subfamily Myrmicinae) comprises 100 described species, and this is the reason why it occupies the 24th position among the 296 genera of the family Formicidae comprising over 9,500 of hitherto known species. *Myrmica* ants are mainly Holarctic forms: 59 species of this genus occur in the Palaearctic and 22 in the Nearctic (plus 18 species in the Oriental and one species in the Neotropical regions) (Bolton 1995b).

Most *Myrmica* species inhabit more or less humid habitats, both forest and open ones, including mountain environments. Also, there are a few semixerophilous steppe forms. Certain species have ranges extending far north – to the forest-tundra natural zone; some also occur in the tundra mountain storeys where they are found at 3600 m above sea level (in the Pamirs) or even at 4500–4800 m a.s.l. (in the Himalayas and in Tibet).

All *Myrmica* ants are predatory; moreover, many species are trophobiotically associated with aphids. They nest in the soil, frequently under stones and pieces of old wood, in rotting tree stumps, in logs and branches lying on the ground, under moss, in tufts of grass, and in litter. Their colonies generally number from several hundred to more than one thousand (sometimes even several thousand) individuals. They are either monogynous or polygynous (the latter may con-



Figure 1. Polish geographical regions: 1 – Baltic Coast (Pobrzeże Bałtyku), 2 – Pomeranian Lake District (Pojezierze Pomorskie), 3 – Masurian Lake District (Pojezierze Mazurskie), 4 – Wielkopolsko-Kujawska Lowland (Nizina Wielkopolsko-Kujawska), 5 – Mazovian Lowland (Nizina Mazowiecka), 6 – Podlasie, 6a – Białowieża Forest (Puszcza Białowieża), 7 – Lower Silesia (Śląsk Dolny), 8 – Upper Silesia (Śląsk Górny), 9 – Krakowско-Wieluńska Upland (Wyżyna Krakowско-Wieluńska), 10 – Małopolska Upland (Wyżyna Małopolska), 10a – Świętokrzyskie Mts (Góry Świętokrzyskie), 11 – Lubelska Upland (Wyżyna Lubelska), 12 – Roztocze, 13 – Sandomierska Lowland (Nizina Sandomierska), 14 – Western Sudeten Mts (Sudety Zachodnie), 15 – Eastern Sudeten Mts (Sudety Wschodnie), 16 – Western Beskidy Mts (Beskidy Zachodnie), 17 – Eastern Beskidy Mts (Beskidy Wschodnie), 18 – Bieszczady Mts (Bieszczady), 19 – Pieniny Mts (Pieniny), 20 – Tatra Mts (Tatry).

tain several dozens of queens) (see Elmes and Keller 1993). Some species are social parasites living in nests of other species of the genus *Myrmica*.

Up till now, no complete revision of the genus has been presented, even though myrmecologists are greatly interested in this group of ants and several papers (including taxonomic ones) have been published about them. Recently, however, there have appeared taxonomic reviews and revisions of *Myrmica* species from certain regions of the Palaearctic (Seifert 1988, Radchenko 1994a–f).

In Poland, the taxonomy of the ants of the genus *Myrmica* was within the scope of Pisarski's interests. Results of his studies (unpublished as such) were taken into consideration in his, now largely outdated, catalogue of the ants of Poland (Pisarski 1975) – part of the series "Katalog Fauny Polski" ("Catalogue of the Fauna of Poland"). The catalogue contains 10 species of *Myrmica* recorded from Poland, and this number was in keeping with the state of faunistic knowledge at that time. The only Polish key to ants, which comprises the genus *Myrmica*, is "Klucz do oznaczania mrówek leśnych" ("Key for identification of forest ants") by Mazur (1995). It comprises seven species of *Myrmica*, arbitrarily considered to be woodland forms.

The present paper consists of two parts. The first part provides a catalogue with a taxonomic review of Polish species of the genus *Myrmica* together with information on their geographical ranges and distribution in Poland, supplemented with notes on their ecology and bionomics. The second part consists of a key for identification of species on the basis of workers and males.

## MATERIAL AND METHODS

The catalogue has been prepared by compiling literature data on the occurrence of particular species in Poland (in the case of the literature up to 1939 – in Poland within the present borders). The division of the country into geographical regions (Fig. 1) has been adopted, with some simplifications, after "Katalog Fauny Polski" (see Pisarski 1975). The literature data have been supplemented by reviewing and verifying the determinations in the ant collections in the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw. During taxonomic studies, museum materials from the Zoological Institute of the National Ukrainian Academy of Sciences in Kiev (including Karawajew's collection), the Zoological Museum of the Moscow University, the Zoological Institute of the Russian Academy of Sciences in Sankt Petersburg, the National Museum in Budapest, the Museum of Natural History in London, and G. W. Elmes' collection in Wareham, Dorset (UK) have also been used.

Complete synonymy is given for the less known species only – in most cases, synonyms cited are those used in the literature concerning the occurrence of a given taxon in Poland; for the rest see Pisarski (1975), Seifert (1988),

Radchenko (1994d–f), and Bolton (1995a). Information on the biology of particular species is compiled on the basis of the literature data, mainly after Pisarski (1975), Collingwood (1979), Seifert (1986, 1988, 1994), Mazur (1995), Saaristo (1995), Wardlaw and Elmes (1996), and of the authors' observations.

In the key, the following measurements and indices are used:

- HL – length of head in full-face view, measured in a straight line from anterior point of median clypeal margin to mid-point of occipital margin;
- HW – maximum width of head in full-face view immediately behind eyes;
- FW – minimum width of frons between frontal lobes;
- FLW – maximum width between external borders of frontal lobes;
- PPW – maximum width of postpetiole from above;
- SL – maximum straight-line length of antennal scape in profile;
- SL' – scape length, measured as in Fig. 2a;
- SW – width of lobe at the base of antennal scape, measured as in Fig. 2a;
- SH – height of antennal scape, measured as in Fig. 2b;
- F (frontal index) = HW:FW;
- FLI (frontal lobe index) = FLW:FW;
- SI (scape index) = SL:HL;
- SWI (scape lobe index) = SL':SW;
- SHI (scape height index) = SL:SH;
- PPI (postpetiolar index) = PPW:HW.

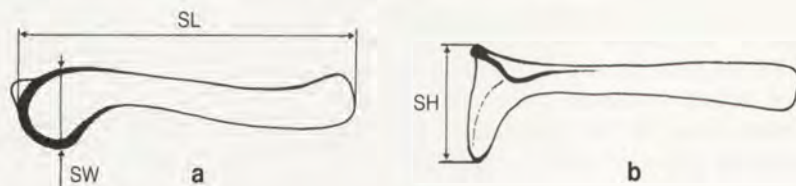


Figure 2. Measurements of antennal scape (a – lateral view, b – dorsal view).

The paper discusses the 13 species of *Myrmica* that have been recorded from Poland (Czechowski and Czechowska 1997):

1. *Myrmica rubra* (Linnaeus, 1758)
2. *Myrmica ruginodis* Nylander, 1846
3. *Myrmica sulcinodis* Nylander, 1846
4. *Myrmica lobicornis* Nylander, 1846
5. *Myrmica rugulosa* Nylander, 1846
6. *Myrmica gallienii* Bondroit, 1920
7. *Myrmica hellenica* Forel, 1913
8. *Myrmica speciosoides* Bondroit, 1918
9. *Myrmica scabrinodis* Nylander, 1846
10. *Myrmica sabuleti* Meinert, 1860
11. *Myrmica lonae* Finzi, 1926
12. *Myrmica hirsuta* Elmes, 1978
13. *Myrmica schencki* Viereck, 1903

## SURVEY OF SPECIES

Genus *Myrmica* Latreille, 1804

*Myrmica* Latreille, 1804: 179. Type species: *Formica rubra* Linnaeus, 1758: 580, by subsequent designation of Latreille 1810: 437.

*Dodecamyrmica* Arnoldi, 1968: 1803 (as subgenus of *Myrmica*). Type species: *Myrmica arnoldii* Dlussky, 1963: 191, by original designation. Synonymy by Francoeur 1981: 759.

*Paramyrmica* Cole, 1957: 37. Type species: *Paramyrmica colax* Cole, 1957: 37, by original designation. Synonymy by Bolton 1988: 4.

*Sifolinia* Emery, 1907: 49 (part.). Type species: *Sifolinia laurae* Emery, 1907: 49, by monotypy. Synonymy by Bolton 1988: 3 (see also Seifert 1994, 1996).

*Sommirma* Menozzi, 1925: 25. Type species: *Sommirma symbiotica* Menozzi, 1925: 25, by original designation. Synonymy by Bolton 1988: 4.

*Myrmica rubra* (Linnaeus, 1758)

*Formica rubra* Linnaeus, 1758: 580.

*Myrmica rubra laevinodis*: Kulmatycki 1920a,b, 1922, Bischoff 1925, Scholz 1926, Novotny 1931a, Griep 1938.

*Myrmica rubra*: Begdon 1954 (part.), Pętal *et al.* 1970, Czerwiński *et al.* 1971, Jakubczyk *et al.* 1972, Woyciechowski 1987, 1990a,b,c.

*Myrmica laevinodis* Nylander, 1846: 927.

*Myrmica laevinodis*: Jakubisiak 1948 (misspelling).

*Myrmica laevinodis* var. *europaea* Finzi, 1926: 84; first available name for *Myrmica rubra* subsp. *champlaini* var. *europaea* Forel, 1911: 457, name unavailable; Koehler 1951: 21, syn. nov.

**Note.** Pisarski (1975) in his catalogue disagreed with Yarrow's (1955) opinion that the name *M. laevinodis* Nylander, 1846 is a junior synonym of *M. rubra* (Linnaeus, 1758), and thus *M. rubra*, a very common and widely known species, is referred to as *M. laevinodis* in most of the Polish myrmecological literature (and practically nowhere else now).

**General distribution** (Fig. 3). The species known from almost entire Europe and Palaearctic Asia: from Portugal to Japan and from northern Italy to the forest-tundra natural zone. Rare in the Caucasus and in the mountains of Central Asia, very rare in the Far East. Introduced to North America.

**Distribution in Poland** (Fig. 4, Table 1). Baltic Coast (Kulmatycki 1922, Mazur 1983); Pomeranian Lake District (Kulmatycki 1922, Begdon 1932, Griep 1938, Jacobson 1940, Będziak 1956, Szujecki *et al.* 1978, 1983, Mazur 1983); Masurian Lake District (Begdon 1932, Wengris 1962, 1963, 1977, Mazur 1983, Krzysztofiak 1985); Wielkopolsko-Kujawska Lowland (Kulmatycki 1922, Begdon 1932, Stawarski 1966, Kietczewski and Wiśniewski 1971, Pawlikowski and Sobieszczyk 1980); Mazovian Lowland (Nasonov 1889, 1892, 1894, Kulmatycki 1920b, Jakubisiak 1948, Kaczmarek 1963, Pętal 1967, 1968b, 1976, 1980b, 1981, Pętal and Breymeyer 1969, Pętal *et al.* 1970, 1971, Czerwiński *et al.* 1971, Jakubczyk *et al.* 1972, Czechowski 1976, 1984a,b, 1985, 1990, 1991, Czechowski, Czechowska and Palmowska 1990, Czechowski and Pisarski 1990a,b, Czechowski, Pisarski and Czechowska 1990), Pisarski and Czechowski 1978, Pisarski 1981, 1982, Vepsäläinen and Pisarski 1982, Bańkowska *et al.* 1984; Podlasie (Kulmatycki 1920b, Wiąckowski 1957, Pętal 1963b, 1968a, Pętal *et al.* 1992); Białowieża Forest (Bischoff 1925, Karpiński 1956, Czechowski *et al.* 1995); Lower Silesia (Stawarski 1961, 1966); Upper Silesia (Scholz 1926, Novotny 1931a, Stawarski 1966); Krakowsko-Wieluńska Upland (Wierzejski 1868, 1873, Kulmatycki 1920a, Kaczmarek 1953); Małopolska Upland (Kulmatycki 1920b, Puszkarski 1982); Świętokrzyskie Mts (Kulmatycki 1920b, Krzysztofiak 1984); Lubelska Upland (Kulmatycki 1920b, Pisarski 1953, Pętal 1961, Honezarenko 1964, Puszkarski 1978, 1982); Roztocze (Kulmatycki 1920b, Pętal 1961, 1964, Mazur 1983); Sandomierska Lowland (Kulmatycki 1920b, Stawarski 1966, Puszkarski 1979, 1982, Mazur 1983); Western Sudeten Mts (Scholz 1912, Pax 1937, Stawarski 1966, Dominiak 1970, Banert and Pisarski 1972); Eastern Sudeten Mts (Stawarski 1966, Banert and Pisarski 1972); Western Beskidy Mts (Kulmatycki 1920b, Dominiak 1970, Woyciechowski and Miszta 1976); Eastern Beskidy Mts (Kulmatycki 1920b, Pętal *et al.* 1970); Bieszczady Mts (Parapura and Pisarski 1971, Pisarski 1971); Pieniny Mts (Koehler 1951, Pętal 1974, 1980b, Czechowska 1976, Woyciechowski 1985, 1987, 1990a,b); Tatra Mts



Figure 3. Distribution of *M. rubra* in Palaearctic.



Figure 4. Distribution of *M. rubra* in Poland.

(Kulmatycki 1920b, J. Łomnicki 1931, Woyciechowski 1990c); «Eastern and Western Prussia» (Brischke 1888b).

**Biology.** A eurytopic, the most hygrophilous and yet the most tolerant species of all Central-European *Myrmica*, one of the commonest in the Palaearctic. It occurs in very diverse habitats (from mesophilous to very wet), especially in lowlands. Particularly numerous in meadows with a high level of ground water; it withstands a lush herbaceous cover. The species frequently occurs in anthropogenic habitats (gardens, agrocoenoses). It is rarer in forests (substituted there by the sibling species *M. ruginodis*). It nests in the soil, in tufts of grass and moss, under stones, in rotting wood, under bark; nests often with a small mound of soil or of plant remnants. Colonies, generally polygynous ones, number several thousand (occasionally over 10,000) individuals and may form polycalic systems. Very aggressive ants (even towards man); they frequently wage fierce intra- and interspecific combats. They utilize honeydew of aphids and scale insects (even those on trees) more than do other *Myrmica*; they also drink nectar (they are seen mainly on the inflorescence of umbelliflorae). Nuptial flights take place in August and September (in the mountains even in October) and are directed towards elevations (swarming sites).

The species common all over Poland; in the mountains, it reaches the lower subalpine forests.

### *Myrmica ruginodis* Nylander, 1846

*Myrmica ruginodis* Nylander, 1846: 929.

*Myrmica rubra* r. *ruginodis*: Kulmatycki 1920a, 1920b, 1922, Pongrácz 1924, Bischoff 1925.

*Myrmica rubra* subsp. *ruginodis*: Novotny 1931b, Griep 1938.

*Myrmica rubra* var. *ruginodo-laevinodis* Forel, 1874: Kulmatycki 1920 a,b, 1922.

*Myrmica ruginodis* var. *ruginodo-laevinodis*: Nasonov 1892, Koehler 1951, Stawarski 1966.

*Myrmica ruginodo-laevinodis*: Jacobson 1940 (*Myrmica*).

*Myrmica rubra*: Begdon 1954 (part.), Kaczmarek 1963, Pisarski 1975, nec Linnaeus 1758 et auct., Puszkar 1978, Szujewski *et al.* 1978, 1983, Pawlikowski and Sobieszczek 1980, Mazur 1983.

*Myrmica rubra* var. *microgyna* Brian et Brian, 1949: Kaczmarek, 1963.

**Note.** In his catalogue, Pisarski (1975) wrongly ascribed the name *M. rubra* (Linnaeus, 1758) to this species. Nevertheless, the correct name is used in most of the later Polish literature (including the papers of Pisarski himself).

**General distribution** (Fig. 5). The compact range of the species extends from West Europe (the British Isles, France) across Central, North and East Europe to Siberia and to the Far East. Very common in the Caucasus, absent in the mountains of Central Asia.

**Distribution in Poland** (Fig. 6, Table 1). Baltic Coast (Kulmatycki 1922, Jacobson 1940, Mazur 1983); Pomeranian Lake District (Begdon 1932, Griep 1938, Jacobson 1940, Będziak 1956, Szujewski *et al.* 1978, 1983, Mazur 1983, Czechowski *et al.* 1995); Masurian Lake District (Begdon 1932, Wengris 1962, 1963, 1977, Mazur 1983, Krzysztofiak 1985); Wielkopolsko-Kujawska Lowland (Kulmatycki 1922, Begdon 1932, Kiełczewski and Wiśniewski 1966, 1971, Stawarski 1966, Pawlikowski and Sobieszczek 1980, Mazur 1983); Mazovian Lowland (Nasonov 1889, 1892, Jakubisiak 1948, Wiąckowski 1957, Kaczmarek 1963, Pętał 1967, 1976, 1980b, 1981, Pętał and Breymeyer 1969, Pętał *et al.* 1970, 1971, Czerwiński *et al.* 1971, Jakubczyk *et al.* 1972, Pisarski and Czechowski 1978, Pisarski 1981, 1982, Mazur 1983, Bańkowska *et al.* 1984, Czechowski 1990, 1991, Czechowski and Pisarski 1990a,b, Czechowski, Pisarski and Czechowska 1990, Czechowski *et al.* 1995); Podlasie (Pętał 1968a, Pętał *et al.* 1970, Mazur 1983, Pętał *et al.* 1992); Białowieża Forest (Bischoff 1925, Karpiński 1956, Czechowski *et al.* 1995); Lower Silesia (Kotzias 1930, Stawarski 1966, Mazur 1983); Upper Silesia (Novotny 1931a, Stawarski 1966, Pętał 1980a); Krakowsko-Wieluńska Upland (Wierzejewski 1868, 1873, Kulmatycki 1920a, Kaczmarek 1953); Małopolska Upland (Puszkar 1982, Mazur 1983); Świętokrzyskie Mts (Kulmatycki 1920b, Pongrácz 1924, Krzysztofiak 1984); Lubelska Upland (Kulmatycki 1920b, Pisarski 1953, Puszkar 1978, 1982, Mazur 1983); Roztocze (Kulmatycki 1920b, Pętał 1961, 1964, Mazur 1983); Sandomierska Lowland (Kulmatycki 1920a, Stawarski 1966, Puszkar 1979, 1982, Mazur 1983); Western Sudeten Mts (Harnisch



Figure 5. Distribution of *M. ruginodis* in Palaearctic.



Figure 6. Distribution of *M. ruginodis* in Poland.

Figure 7. Distribution of *M. sulcinodis* in Palaearctic.Figure 8. Distribution of *M. sulcinodis* in Poland.

1924, Pax 1937, Stawarski 1966, Dominiak 1970, Banert and Pisarski 1972); Eastern Sudeten Mts (Stawarski 1966, Banert and Pisarski 1972); Western Beskidy Mts (Kulmatycki 1920a, Czechowski 1989); Eastern Beskidy Mts (Czechowski *et al.* 1998); Bieszczady Mts (Parapura and Pisarski 1971, Pisarski 1971); Pieniny Mts (Koehler 1951, Pełal 1974, 1980b, Czechowska 1976, Woyciechowski 1985, 1987, 1990a); Tatra Mts (Kulmatycki 1920a, J. Łomnicki 1931, A. Łomnicki 1963, Woyciechowski 1990c); «Western and Eastern Prussia» (Brischke 1888b).

**Biology.** A polytopic species of moist habitats, the least thermophilous one of the European *Myrmica*; particularly frequent in forests (and in mountain open habitats above 1000 m a.s.l.), where it replaces the sibling species *M. rubra*. It avoids dry and highly insolated places and, unlike *M. rubra*, highly anthropogenized habitats. Nests as in the previous species. It occurs in two social forms: mono- and polygynous (the latter potentially polycalic). These ants are seen at aphids and on flowers. Nuptial flights (directed at swarming sites) in August or September.

The species common throughout Poland; optimum conditions it finds in moist coniferous and in coniferous-deciduous forests. In the mountains it reaches crags; particularly abundant in mountain pastures.

#### *Myrmica sulcinodis* Nylander, 1846

*Myrmica sulcinodis* Nylander, 1846: 934.

*Myrmica sulcinodis* var. *sulcinodo-scabrinodis* Forel, 1874: Kulmatycki 1922.

**General distribution** (Fig. 7). It occurs from the British Isles to the Far East and from the forest-tundra natural zone to the southern limit of the coniferous forest zone in European plains, and in the eastern part of the Palaearctic to Mongolia and North Korea. It also occurs in the mountains of Europe and the Caucasus; absent in the mountains of Central Asia.

**Distribution in Poland** (Fig. 8, Table 1). Western Sudeten Mts (Banert and Pisarski 1972, Czechowski, Czechowska and Radchenko 1997; Western Beskidy Mts (Kulmatycki 1920a); Pieniny Mts (Koehler 1951, Pełal 1974,

1980b, Woyciechowski 1990a); Tatra Mts (J. Łomnicki 1931, Woyciechowski 1990c).

Questionable localities. Mazovian Lowland: Warsaw (Nasonov 1892); Lubelska Upland: Stawska Góra near Chełm, Gródek near Tomaszów Lubelski (Pełal 1961); Roztocze: Bukowa Góra near Zamość (Pełal 1961).

**Biology.** A Boreal-montane species; in South Europe and in the Caucasus it occurs at 1400–2600 m a.s.l., in Central Europe at 800–1800 m a.s.l., but farther to the North it inhabits lowland habitats – open and well-insolated (well-drained peat-bogs, moorlands, sandy patches). It nests in the soil, occasionally under stones; nests generally without mounds (in moister places sometimes with small mounds of plant remnants, for brood incubation). It forms fairly small colonies (a few hundred individuals), monogynous as a rule. *M. sulcinodis* are typical predators and scavengers. Nuptial flights take place in August and September, mating takes place in the air, over elevations.

The species very rare in Poland; certain sites are only in the mountains.

#### *Myrmica lobicornis* Nylander, 1846

*Myrmica lobicornis* Nylander, 1846: 932.

*Myrmica scabrinodis* var. *lobicornis*: Griep 1938.

**General distribution** (Fig. 9). Distribution similar to that of the previous species but the compact range in Europe extends farther south (to the deciduous forest zone), whereas in Asia it extends only to Transbaikal.

**Distribution in Poland** (Fig. 10, Table 1). Baltic Coast (Czechowski *et al.* 1998); Pomeranian Lake District (Begdon 1932, Griep 1938, 1940, Szujecki *et al.* 1978, 1983, Mazur 1983, Czechowski *et al.* 1995); Masurian Lake District (Begdon 1932, Wengris 1977, Mazur 1983); Wielkopolsko-Kujawska Lowland (Kulmatycki 1922, Pawlikowski and Sobieszczyk 1980, Mazur 1983); Mazovian Lowland (Kaczmarek 1963, Pisarski and Czechowski 1978, Pisarski 1981, 1982, Mazur 1983, Czechowski 1990, Czechowski, Pisarski and Czechowska 1990, 1995); Podlasie (Mazur 1983); Białowieska Forest (Karpiński 1956, Czechowski *et al.* 1995); Lower Silesia

Figure 9. Distribution of *M. lobicornis* in Palaearctic.Figure 10. Distribution of *M. lobicornis* in Poland.

(Mazur 1983); Upper Silesia (Novotny 1931a, 1937); Krakowsko-Wieluńska Upland (Kulmatycki 1920a, Kaczmarek 1953); Malopolska Upland (Puszkarski 1982, Mazur 1983); Świętokrzyskie Mts (Kulmatycki 1920b, Mazur 1983, Krzysztofiak 1984); Lubelska Upland (Minkiewicz 1935, Pisarski 1953, Puszkarski 1978, 1982, Mazur 1983); Roztocze (Petal 1961, Mazur 1983); Sandomierska Lowland (Puszkarski 1982, Mazur 1983); Eastern Sudeten Mts (Banert and Pisarski 1972); Western Beskidy Mts (Kulmatycki 1920a, Woyciechowski and Miszta 1976, Czechowski and Pisarski 1988); Bieszczady Mts (Parapura and Pisarski 1971); Pieniny Mts (Koehler 1951, Czechowska 1976, Woyciechowski 1985, 1987, 1990a); Tatra Mts (Woyciechowski 1990c); «Western and Eastern Prussia» (Brischke 1888b).

**Biology.** An oligotope of coniferous forests (but enters coniferous-deciduous ones), also recorded from meadows and pastures, including xerothermal sites. Nowhere very numerous. Nests in the soil, litter, moss, under stones, in rock crevices. The species forms monogynous colonies with a few hundred individuals at most. Workers forage individually; they belong to the least aggressive *Myrmica* ants. Nuptial flights in July and August.

In Poland, the species probably occurs all over the country (not recorded only from the Western Sudeten and

the Eastern Beskidy); in the mountains, it reaches up to the upper subalpine forests.

### *Myrmica rugulosa* Nylander, 1849

*Myrmica rugulosa* Nylander, 1849: 32.

*Myrmica scabrinodis* var. *rugulosa*: Kulmatycki 1920a.

*Myrmica scabrinodis* r. *rugulosa*: Kulmatycki 1922.

*Myrmica clandestina* Foerster, 1850: Brischke, 1888.

*Myrmica rugulosa* var. *scabrinodo-rugulosa* Nasonov, 1892: 9, nomen nudum.

**General distribution** (Fig. 11). It occurs from West Europe (France), across Central and East Europe, Middle Ural Mts., the southern part of Western Siberia, northern Kazakhstan to the Altai Range. In Europe, the northern limit of its range extends across southern Sweden and southern Finland, and the southern limit across northern Italy. The species also inhabits the Pyrenees, Balkans and Caucasus.

**Distribution in Poland** (Fig. 12, Table 1). Baltic Coast (Kulmatycki 1922); Pomeranian Lake District (J. Łomnicki 1924, Begdon 1932, Jacobson 1940, Szujecki *et al.* 1978, 1983, Mazur 1983); Masurian Lake District (Begdon 1932, Wengris 1977, Mazur 1983, Krzysztofiak 1985); Wielkopolsko-Kujawska Lowland (Begdon 1932, Pawlikowski and Sobieszczyk 1980); Mazovian Lowland (Nasonov 1892, Jakubisiak 1948, Kaczmarek 1963,

Figure 11. Distribution of *M. rugulosa* in Palaearctic.Figure 12. Distribution of *M. rugulosa* in Poland.

Banaszak *et al.* 1978, Pisarski and Czechowski 1978, Czechowski 1979, 1985, 1990, 1991, Czechowski, Czechowska and Palmowska 1990, Czechowski and Pisarski 1990a, Czechowski, Pisarski and Czechowska 1990, Czechowski *et al.* 1979, Pisarski 1981, 1982); Podlasie (Mazur 1983); Białowieśka Forest (Czechowski 1994); Lower Silesia (Stawarski 1966); Upper Silesia (Novotny 1931a); Krakowsko-Wieluńska Upland (Nowicki 1864, 1865, Wierzejski 1873, Kulmatycki 1920a, Kaczmarek 1953); Małopolska Upland (Puszkar 1982); Świętokrzyskie Mts (Krzysztofciak 1984); Lubelska Upland (Minkiewicz 1935, Pisarski 1953, Honeczarenko 1964); Roztocze (Czechowski *et al.* 1998); Sandomierska Lowland (Puszkar 1982); Western Sudeten Mts (Harnisch 1924, Banert and Pisarski 1972); Eastern Sudeten Mts (Stawarski 1966); Western Beskidy Mts (Kulmatycki 1920a, Czechowski and Pisarski 1988); Eastern Beskidy Mts (Czechowski *et al.* 1998); Bieszczady Mts (Parapura and Pisarski 1971, Pisarski 1971, Czechowski 1979); Pieniny Mts (Koehler 1951, Pętał 1974, 1980b Czechowska 1976, Woyciechowski 1985, 1990a); Tatra Mts (Nowicki 1864, 1865, Wierzejski 1868, 1873, J. Łomnicki 1931, Woyciechowski 1990c); «Western and Eastern Prussia» (Brischke 1888b).

**Biology.** A polytopic thermophilous species of dry habitats. Frequent in well-insolated open habitats with not very lush vegetation, in mid-forest clearings and in fallow land; in the mountains, it occurs on river terraces and on dry slopes. Tolerant to human pressure – in Central Europe, no other *Myrmica* inhabits urban lawns more abundantly. It nests in the soil; nest entrances are frequently surrounded by circular sand embankments. Societies are polygynous (occasionally polycaelic) and very numerous – a single colony may comprise several thousand individuals. *M. rugulosa* is primarily a scavenger; it also utilizes honeydew of aphids on herbaceous plants. Unlike most other *Myrmica* species this species forages in groups. It is a typical non-aggressive opportunistic species – in the presence of superior ants (e.g. *Lasius niger*) it withdraws without fight. Nuptial flights from August to October.

In Poland, abundant all over the country; in the mountains it reaches up to the lower subalpine forest (in the Tatra Mts even to the upper subalpine forest).

### *Myrmica gallieni* Bondroit, 1920

*Myrmica gallieni* Bondroit, 1920: 150.

*Myrmica rolandi*: Jacobson 1940, nec. Bondroit 1918 et auct.

*Myrmica jacobsoni* Kutter, 1963: Pisarski 1975, Pętał *et al.* 1992.

*Myrmica lemanica* subsp. *jacobsoni* Kutter: Pętał 1980b (misspelling).

*Myrmica limanica* subsp. *jacobsoni* Kutter: Pętał 1981, Pisarski 1982, Uchmański and Pętał 1982.

**General distribution** (Fig. 13). The species widely distributed in deciduous-forest and in mixed-forest zones; it occurs in Central and East Europe and in Western Siberia, in the North extending to southern-eastern Finland and the Nizhegorodsky district in Russia, in the South to Bulgaria and the steppe zone where it lives in intrazonal habitats. Recorded also from Dagestan.

**Distribution in Poland** (Fig. 14, Table 1). Baltic Coast (Czechowski, Czechowska and Radchenko 1997); Pomeranian Lake District (Jacobson 1940); Wielkopolsko-Kujawska Lowland (Czechowski, Czechowska and Radchenko 1997); Mazovian Lowland (Pętał 1980b, 1981, Uchmański and Pętał 1982, Czechowski, Czechowska and Radchenko 1997); Podlasie (Pętał *et al.* 1992, Czechowski, Czechowska and Radchenko 1997); Białowieśka Forest (Czechowski, *et al.* 1998a); Małopolska Upland (Czechowski, Czechowska and Radchenko 1997); Roztocze (Czechowski, Czechowska and Radchenko 1997).

**Biology.** A hygrophilous, thermophilous and facultatively halophilous species. Its typical habitats are moist meadows and swamps, frequently (but not obligatorily) saline ones; on the Baltic coast, it occurs in periodically flooded silty coastal meadows or even in sand dunes. In moist habitats, it builds shallow nests with a soil mound but in dunes the nests are situated deep in the sand. Colonies are large, with thousands of individuals. In its lifestyle *M. gallieni* resembles *M. rubra* – the ants climb plants and are rather aggressive. Nuptial flights in August and September.

In Poland, *M. gallieni* populations were recorded in the «Łąki Strzeleckie» meadow reserve (Stellario-Deschamp-



Figure 13. Distribution of *M. gallieni* in Palearctic.



Figure 14. Distribution of *M. gallieni* in Poland.

Figure 15. Localities of *M. hellenica* in Palaearctic.

sietum) in the Kampinos National Park in Mazovian Lowland and in drained peat-bogs, utilized as meadows, in the Narew and Biebrza valleys in Podlasie.

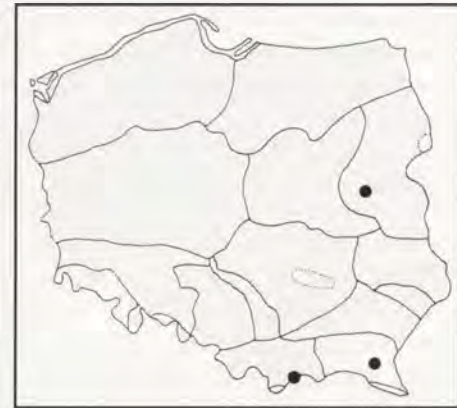
#### *Myrmica hellenica* Finzi, 1926

*Myrmica rugulosa* var. *hellenica* Finzi, 1926: 93, first available name for *Myrmica scabrinodis* r. *rugulosa* var. *hellenica* Forel, 1913: 431, name unavailable.

**General distribution** (Fig. 15). Widely but locally spread in South and Central Europe; known from Greece, Bulgaria, northern Italy, Switzerland, Austria, southern Germany, the Czech Republic, Poland and southern Finland.

**Distribution in Poland** (Fig. 16, Table 1). Podlasie: Siedlee (Czechowski, Radchenko and Czechowska 1997); Eastern Beskidy Mts: Międzygrodzie near Sanok (Czechowski, Radchenko and Czechowska 1997); Pieniny Mts: Sromowce Wyżne (Czechowski, Radchenko and Czechowska 1997).

**Biology.** A little known species, probably of pioneer character. It inhabits xerothermal habitats (only superficially dry) with sandy soils, scantily covered with vegetation: river terraces, banks of stagnant waters, exposed slopes. Nests in the ground – among grass roots or deep in sand; occasionally under stones. Colonies fairly big (a few hundred to 1600 individuals), at least sometimes with several queens.

Figure 16. Localities of *M. hellenica* in Poland.

In Poland, most of the *M. hellenica* nest recorded were situated on an open sunny mountain slope in Eastern Beskidy Mts (Eastern Beskid Mts) and on sandy or stony terraces of the river Dunajec, covered with sparse herb vegetation (Pieniny Mts).

#### *Myrmica specioides* Bondroit, 1918

*Myrmica specioides* Bondroit, 1918: 100.

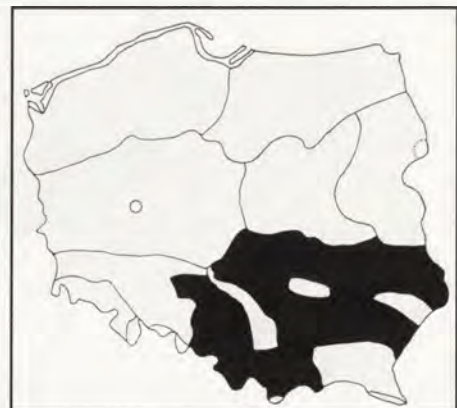
*Myrmica scabrinodis* subsp. *rugulosoides*: Kulmatycki 1920a (part.), Novotny 1937 (part.), nec Forel 1915 et auct.

*Myrmica scabrinodis*: Pisarski 1953 (part.), nec Nylander 1846 et auct. *?sulcinodo-scabrinodis*: Kulmatycki 1922 (*sulcinodis* var.), nec Forel 1915.

**Note.** For a long time, many authors considered *M. specioides* to be a junior synonym of different species (see Bolton 1995a). Seifert (1988) considered it to be a good species. We approve of Seifert's taxonomic interpretation and will follow it until special studies have been carried out.

**General distribution** (Fig. 17). West and Central Europe, northern part of the Balcan Peninsula. Despite the information of Collingwood (1979), absent in Finland (Saaristo, personal comm.).

**Distribution in Poland** (Fig. 18, Table 1). Upper Silesia (Novotny 1937); Malopolska Upland (Puszkar 1982, Czechowski, Czechowska and Radchenko 1997); Lubelska Upland (Pisarski 1953); Sandomierska Lowland (Puszkar

Figure 17. Distribution of *M. specioides* in Palaearctic.Figure 18. Distribution of *M. specioides* in Poland.



1982, Czechowski, Czechowska and Radchenko 1997); Western Beskidy Mts (Kulmatycki 1920a); Pieniny Mts (Woyciechowski 1990a).

Probable locality: Wielkopolsko-Kujawska Lowland: Gądki near Śrem (Kulmatycki 1922).

**Biology.** The most xerophilous species of all Central-European *Myrmica*. It mainly inhabits open areas, with scanty and low herbaceous vegetation. It builds inconspicuous nests in the soil with one or a few simple entrance holes. Colony size hardly exceeds a thousand individuals; generally, there is one or several queens in the nest, but there are clearly polygynous colonies too. *M. specioides* are very aggressive and predatory ants; they often prey on workers and brood of *Lasius flavus* (F), their frequent neighbours. They have been recorded climbing herbaceous plants to reach the flowers and aphids. Nuptial flights in August and September.

In Poland, the species is recorded from few sites in the southern and southern-eastern part of the country; it has been found in xerothermal patches, mainly with calcareous or gypseous subsoil.

### *Myrmica scabrinodis* Nylander, 1846

*Myrmica scabrinodis* Nylander, 1846: 930.

*Myrmica scabrinodis* var. *rugulosoides* Forel, 1915: 29.

*Myrmica scabrinodis* subsp. *rugulosoides*: Kulmatycki 1920a (part.), Novotny 1937 (part.), Stawarski 1966.

*Myrmica rugulosoides*: Begdon 1954, 1956, Pętał 1963a,b, 1964, 1968a. (See also Seifert 1984).

**General distribution** (Fig. 19). A Transpalaeartic species which in the North reaches up to the Polar Circle and in the East to Eastern Siberia and to the mountains in Central Asia. The southern limit of its range in Europe is difficult to determine because there have been many misidentifications.

**Distribution in Poland** (Fig. 20, Table 1). Bałtic Coast (Czechowski *et al.* 1998); Pomeranian Lake District (Begdon 1932, Engel 1938, Griep 1938, Jacobson 1940, Będziak 1956, Szujcecki *et al.* 1983, Mazur 1983, Czechowski *et al.* 1995); Masurian Lake District (Begdon 1932, Wengris 1962, 1963, 1965, 1977, Szujcecki *et al.* 1978, Mazur 1983, Krzysztofiak 1985); Wielkopolsko-Kujawska

Lowland (Kuhlgatz 1909, Begdon 1932, Kieleczewski and Wiśniewski 1966, Stawarski 1966, Pawlikowski and Sobieszczyk 1980, Mazur 1983); Mazovian Lowland (Jakubisiak 1948, Kaczmarek 1963, Pętał 1967, 1976, 1980b, Pętał and Breymeyer 1969, Pętał *et al.* 1970, Czerwiński *et al.* 1971, Jakubczyk *et al.* 1972, Pisarski and Czechowski 1978, Pisarski 1981, 1982, Mazur 1983, Czechowski 1990, 1991, Czechowski and Pisarski 1990b, Czechowski, Pisarski and Czechowska 1990, Czechowski *et al.* 1995); Podlasie (Pętał 1963b, 1968a, Pętał *et al.* 1992, Mazur 1983); Białowieża Forest (Bischoff 1925, Karpiński 1956, Czechowski *et al.* 1995); Lower Silesia (Letzner 1877, Stawarski 1966, Mazur 1983); Upper Silesia (Novotny 1931a, Stawarski 1966); Wyżyna Krakowsko-Wieluńska (Nowicki 1864, 1865, Wierzejski 1868, 1873, Kulmatycki 1920a, Kaczmarek 1953); Małopolska Upland (Puszkar 1982, Mazur 1983); Świętokrzyskie Mts (Kulmatycki 1920b, Mazur 1983, Krzysztofiak 1984); Lubelska Upland (Pisarski 1953, Pętał 1961, 1963a, Puszkar 1978, 1982, Mazur 1983); Roztocze (Kulmatycki 1920a, Pętał 1961, 1963a, 1964, Mazur 1983); Sandomierska Lowland (Stawarski 1966, Puszkar 1982, Mazur 1983); Western Sudeten Mts (Stawarski 1966, Banert and Pisarski 1972); Eastern Sudeten Mts (Stawarski 1966, Banert and Pisarski 1972); Western Beskidy Mts (Kulmatycki 1920a, Woyciechowski and Miszta 1976, Czechowski and Pisarski 1988); Bieszczady Mts (Parapura and Pisarski 1971); Pieniny Mts (Koehler 1951, Pętał 1974, 1980b, Czechowska 1976, Woyciechowski 1985, 1990a); Tatra Mts (Nowicki 1864, 1864, Wierzejski 1868, 1873, Woyciechowski 1990c); «Western and Eastern Prussia» (Brischke 1888b).

**Biology.** A polytopic mesothermophilous species of moist habitats. It requires great insolation but is very tolerant of soil moisture; it only avoids definitely xerothermal places (there are many false reports about *M. scabrinodis* occurring in such habitats, reports based on misidentification of *M. specioides* or *M. sabuleti*). The species occurs both in open areas (meadows, pastures) and in forests as well (but only in highly insolated patches); it frequently occurs in peat-bogs (specimens from peat-bogs, which are smaller and have a less curved antennal scapus, have often



Figure 19. Distribution of *M. scabrinodis* in Palaearctic.



Figure 20. Distribution of *M. scabrinodis* in Poland

Figure 21. Distribution of *M. sabuleti* in Palaearctic.Figure 22. Distribution of *M. sabuleti* in Poland.

been identified as *M. rugulosoides*). Nests are built in the ground, in tufts of grass or moss (these nests sometimes with small mounds), and also in rotten wood; in dry spots under stones. Colonies are monogynous or with a few queens; they contain several hundred to 2500 workers. *M. scabrinodis* are highly predatory ants; their nests often are next to mounds of *Lasius niger*, whose kidnapped brood provides them with a source of easily available protein food. They also utilize honeydew of aphids on roots and shoots of herbaceous plants. Nuptial flights from July to October.

In Poland, common almost all over the country (not recorded only from the Eastern Beskidy); in the mountains, it reaches the upper subalpine forests.

### *Myrmica sabuleti* Meinert, 1861

*Myrmica sabuleti* Meinert, 1861: 327.

*Myrmica scabrinodis* var. *sabuleti*: Kulmatycki 1920a, 1920b, Begdon 1932.

*Myrmica scabrinodis* subsp. *sabuleti*: Novotny 1937.

*Myrmica scabrinodis* f. *sabuleti*: Begdon 1954.

**General distribution** (Fig. 21). It occurs in Europe up to Norway, Sweden and the Sankt Petersburg district in Russia, in Western Siberia to the Altai, and in the Caucasus.

**Distribution in Poland** (Fig. 22, Table 1). Baltic Coast (Czechowski *et al.* 1998); Pomeranian Lake District (Begdon 1932, Szujewski *et al.* 1978, 1983, Mazur 1983, Czechowski *et al.* 1995); Masurian Lake District (Mazur 1983); Wielkopolsko-Kujawska Lowland (Mazur 1983); Mazovian Lowland (Kaczmarek 1963, Pisarski and Czechowski 1978, Pisarski 1981, 1982, Mazur 1983, Czechowski and Pisarski 1990b, Czechowski *et al.* 1995); Podlasie (Mazur 1983); Białowieża Forest (Czechowski *et al.* 1995); Lower Silesia (Mazur 1983); Upper Silesia (Novotny 1937); Krakowsko-Wieluńska Upland (Kulmatycki 1920a, Kaczmarek 1953); Małopolska Upland (Puszkar 1982, Mazur 1983); Świętokrzyskie Mts (Kulmatycki 1920b, Mazur 1983, Krzysztofiak 1984); Lubelska Upland (Pisarski 1953, Puszkar 1978, 1982, Mazur 1983); Roztocze (Pętał 1961, Mazur 1983);

Sandomierska Lowland (Mazur 1983); Western Sudeten Mts (Banert and Pisarski 1972); Eastern Sudeten Mts (Banert and Pisarski 1972); Western Beskidy Mts (Kulmatycki 1920a); Eastern Beskidy Mts (Czechowski *et al.* 1998); Bieszczady Mts (Parapura and Pisarski 1971); Pieniny Mts (Koehler 1951, Czechowska 1976, Pętał 1974, 1980b, Woyciechowski 1985, 1987, 1990a, Czechowska and Radchenko 1997); Tatra Mts (Kulmatycki 1920a).

**Biology.** A moderately xerothermophilous species, which generally prefers habitats slightly drier and warmer than those inhabited by *M. scabrinodis* (yet in Poland, it is also found in wet areas, even in peat-bogs). It occurs both in open habitats and in forests as well. Nests are built in the ground, in tufts of grass and moss, under stones. Colonies generally number a few hundred (maximum up to 2000) workers and several queens. Workers very frequently (and occasionally in great numbers) forage in herbaceous vegetation (or even in shrubs) in search of nectar and honeydew. They are not aggressive; in encounters with other ants they avoid conflict. Nuptial flights in August and September.

In Poland, the species is common all over the country; in the mountains, it reaches the lower subalpine forests (in the Bieszczady Mts, even the upper ones).

### *Myrmica lonae* Finzi, 1926

*Myrmica scabrinodis* subsp. *lonae* Finzi, 1926: 103.

*Myrmica scabrinodis* var. *lonae*: Karawajew 1929.

*Myrmica sabuleti* st. *lonae*: Santschi 1931.

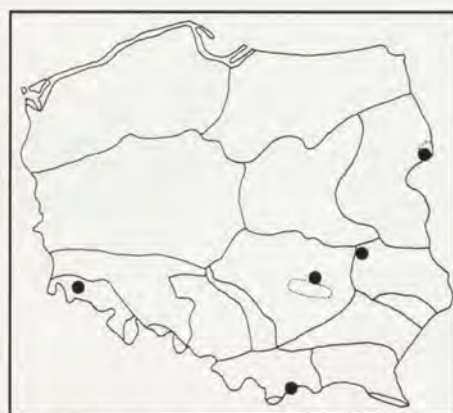
*Myrmica sabuleti* var. *lonae*: Stitz 1939, Czechowska 1976.

*Myrmica sabuleti* subsp. *lonae*: Weber 1948.

?*Myrmica rubra* var. *scabrinodo-lobicornis* Forel, 1874: Sadil 1952 (see a note below).

*Myrmica sabuleti* Meinert, 1860. Synonymy by Bernard 1967: 117. Arnoldi 1970: 1841, Seifert 1988: 31, Atanasov and Dlussky 1992: 97, Radchenko 1994d: 80.

**Note.** During many years this species was treated as a subspecies or variety of *M. scabrinodis* or *M. sabuleti*, or as synonym of the latter. Santschi (1931) recognized var. *scabrinodo-lobicornis* Forel, 1874 to be an infrasubspecific form of *M. sabuleti lonae* Finzi, 1926; this combination however is unacceptable from the viewpoint of the

Figure 23. Localities of *M. lonae* in Palaearctic.Figure 24. Localities of *M. lonae* in Poland.

modern zoological nomenclature. Later, Sadil (1952) synonymized *M. lonae* with *M. rubra* var. *scabrinodo-lobicornis* and treated *M. lonae* as a senior synonym, although the name *scabrinodo-lobicornis* had priority. Seifert (1994) revived *M. lonae* from synonymy and raised it to species. We agree with this opinion and also consider *M. lonae* to be a good species.

**General distribution** (Fig. 23). The species known from southern Finland (originally reported as *M. sabuleti* Mein.; see Saaristo 1995) and separate localities in the Netherlands, southern Germany, Poland, western Ukraine, Austria, northern Italy, Croatia, Romania, the Sankt Petersburg district in Russia, the southern part of Western Siberia and northern Kazakhstan.

**Distribution in Poland** (Fig. 24, Table 1). Białowieża Forest: Białowieża near Hajnówka (Czechowski, Czechowska and Radchenko 1997); Małopolska Upland: Starachowice (Czechowski, Czechowska and Radchenko 1997); Lubelska Upland: Kazimierz Dolny (Czechowski, Czechowska and Radchenko 1997); Western Sudeten Mts: Pilchowice near Jelenia Góra (Czechowski, Czechowska and Radchenko 1997); Pieniny Mts (Czechowska 1976).

**Biology.** The ecological preferences of this species are poorly known; the (few) data seem to suggest its boreal-montane character; in North Europe, *M. lonae* occurs in plains, in southern Germany – in swamp habitats, and in

Central Europe it inhabits mountain meadows and xerothermal grasslands. Nests in the ground, frequently under stones, also in moss. Its colonies contain several queens and generally up to a thousand workers, occasionally even more.

In Poland, *M. lonae* readily inhabits warm and dry places, mainly insolated rocky slopes, scantily overgrown with herbaceous vegetation.

#### *Myrmica hirsuta* Elmes, 1978

*Myrmica hirsuta* Elmes, 1978: 131, female, male (*Myrmica*): Collingwood 1979, Bolton 1988, Seifert 1988, Vepsäläinen and Pisarski 1982, Elmes 1994, worker, Bolton 1995a, Saaristo 1995, Seifert 1994, 1996, Czechowska and Rädchenko 1997.

**Note.** *M. hirsuta* have been described by Elmes (1978) from southern England based on females and males, which were found in a nest of *M. sabuleti*. At first, the species had been considered to be a workerless social parasite but later also workers have been found (Elmes 1994). In southern Finland, host species of *M. hirsuta* is *M. lonae* (*M. Sabuleti* is absent in Finland; Saaristo 1995).

**General distribution** (Fig. 25). The species known from separate localities in southern England, Germany, Austria, Denmark, Sweden, southern Finland, southern Poland, the former Czechoslovakia and the former Yugoslavia.

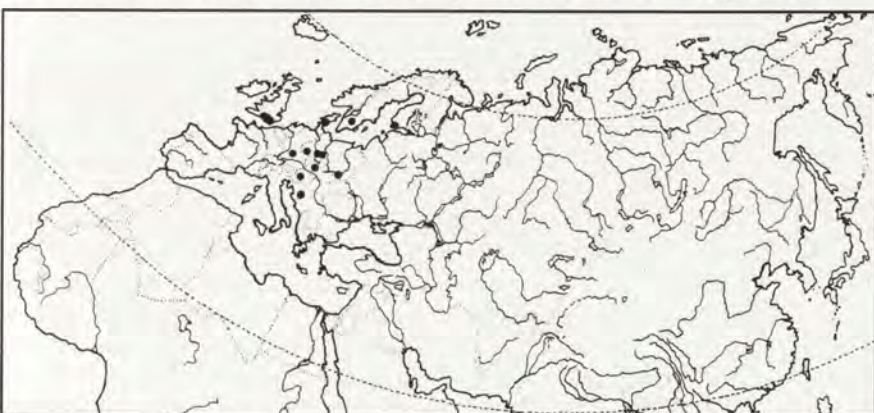
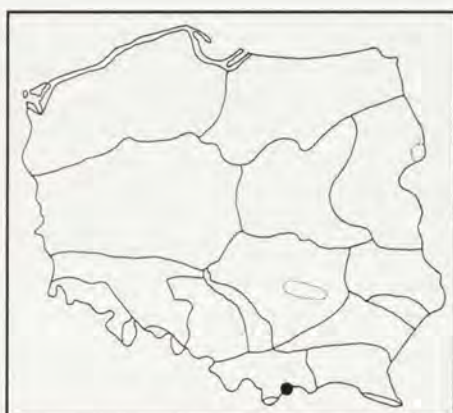
Figure 25. Localities of *M. hirsuta* in Palaearctic.Figure 26. Locality of *M. hirsuta* in Poland.

Figure 27. Distribution of *M. schencki* in Palearctic.Figure 28. Distribution of *M. schencki* in Poland.

**Distribution in Poland** (Fig. 26, Table 1): Pieniny Mts (Czechowska and Radchenko 1997).

**Biology.** Obligatory social parasite (with the worker caste disappearing) of *M. sabuleti* and *M. lonae*.

In Poland, found in four nests of *M. sabuleti* in the Pieniny Mts. All the host nests were situated on xerothermic grasslands on south and south-west slopes of the Mt Trzy Korony at an altitude of 650–680 m.

#### *Myrmica schencki* Viereck, 1903

*Myrmica rubra* var. *schencki* Viereck, 1903: 72, first available name for *Myrmica rubra* subsp. *scabrinodis* var. *schencki* Emery, 1895: 315, name unavailable.

*Myrmica rugulosa* r. *schencki*: Kulmatycki 1922.

*Myrmica scabrinodis* subsp. *schencki*: Novotny 1931a.

**General distribution** (Fig. 27). A Transpalearctic species; the northern limit of its range in Europe runs across southern Norway, Sweden and Finland, whereas the southern limit

across Spain and Italy; in Asia, in the East it reaches North Korea and the southern limit runs across the Tien Shan and central Kazakhstan.

**Distribution in Poland** (Fig. 28, Table 1): Baltic Coast (Czechowski *et al.* 1998); Pomeranian Lake District (Begdon 1932, 1954, Jacobson 1940, Szujecki *et al.* 1978, 1983, Mazur 1983); Masurian Lake District (Wengris 1977, Mazur 1983, Krzysztofiak 1985); Wielkopolsko-Kujawska Lowland (Kulmatycki 1922, Begdon 1932, Stawarski 1966, Kielczewski and Wiśniewski 1971, Pawlikowski and Sobieszczyk 1980, Mazur 1983); Mazovian Lowland (Jakubisiak 1948, Kaczmarek 1963, Pisarski and Czechowski 1978, Pisarski 1981, 1982, Mazur 1983, Czechowski 1990, Czechowski *et al.* 1995); Podlasie (Pętał 1968a, Mazur 1983); Białowieża Forest (Karpiński 1956, Czechowski *et al.* 1995); Lower Silesia (Stawarski 1966, Mazur 1983); Upper Silesia (Novotny 1931a, Stawarski 1966); Krakowsko-Wieluńska Upland (Kaczmarek 1953); Małopolska Upland (Mazur 1983); Lubelska Upland (Pisarski 1953, Pętał 1961, 1962, Puszkas 1978, 1982, Mazur 1983); Roztocze (Pętał 1961); Eastern Sudeten Mts (Czechowski *et al.* 1998); Western

Beskydy Mts: Gorce Mts (Ochotnica Górna, Jaszcze valley, 2.09.1997, leg. W. Czechowski; unpubl. data); Eastern Beskydy Mts (Czechowski *et al.* 1998); Bieszczady Mts (Parapura and Pisarski 1971); Pieniny Mts (Koehler 1951, Begdon 1954, Czechowska 1976, Woyciechowski 1985, 1987, 1990a); Tatra Mts (J. Łomnicki 1931).

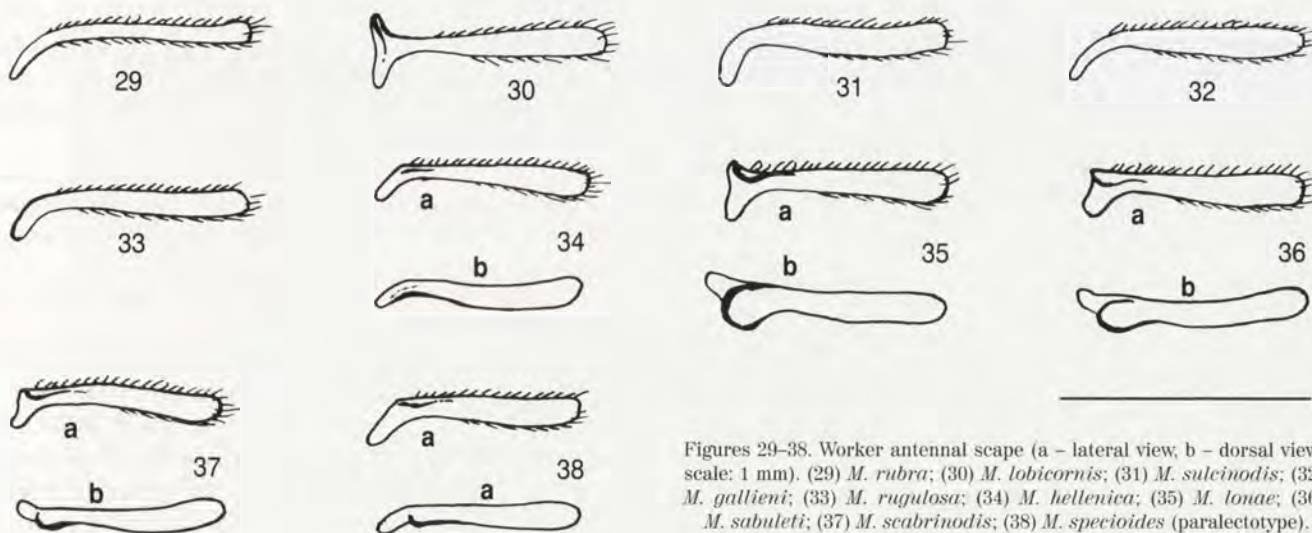
**Biology.** A polytopic species of dry habitats; one of the most thermophilous species among the Central-European *Myrmica* and yet quite tolerant of the habitat temperature. Found both in open areas and in forests as well – in the latter only in insolated patches, on light podsolized soils with poor herbaceous vegetation. Nests are built in the ground, with singular entrance holes, frequently encircled by collar-like embankments of small plant remnants; occasionally nests are in tufts of grass or moss. Colonies are small – they number a few hundred (to 1000) workers and several (up to 5) queens. *M. schencki* are mainly nocturnal ants; they utilize flower nectar more than do other *Myrmica*, but they are very predatory (other ants frequently make a high proportion of their food). Nuptial flights in August and September; mating is on the ground near a nest.

In Poland, it occurs almost all over the country (not recorded from the Świętokrzyskie Mts, the Sandomierska Lowland and the Western Sudeten Mts); nowhere numerous.

#### KEY FOR IDENTIFICATION

##### Workers

- 1 Frontal carinae bending backwards and merging into rugae, wholly surrounding antennal sockets (Fig. 39). Antennal scape weakly curved at base, without angle or carina (Fig. 29) . . . . . 2
- Frontal carinae not bending backwards, projecting beyond the upper level of eyes, antennal sockets not wholly surrounded by rugae (Figs 41 and 42) or if so rugae join the frontal carinae near the upper third of their lengths (Fig. 40). Antennal scape angulate or more or less strongly curved at base (Figs 30–38) . . . 3
- 2 Petiolar node rounded at the apex, without a distinct horizontal plate; nodes of petiole and postpetiole

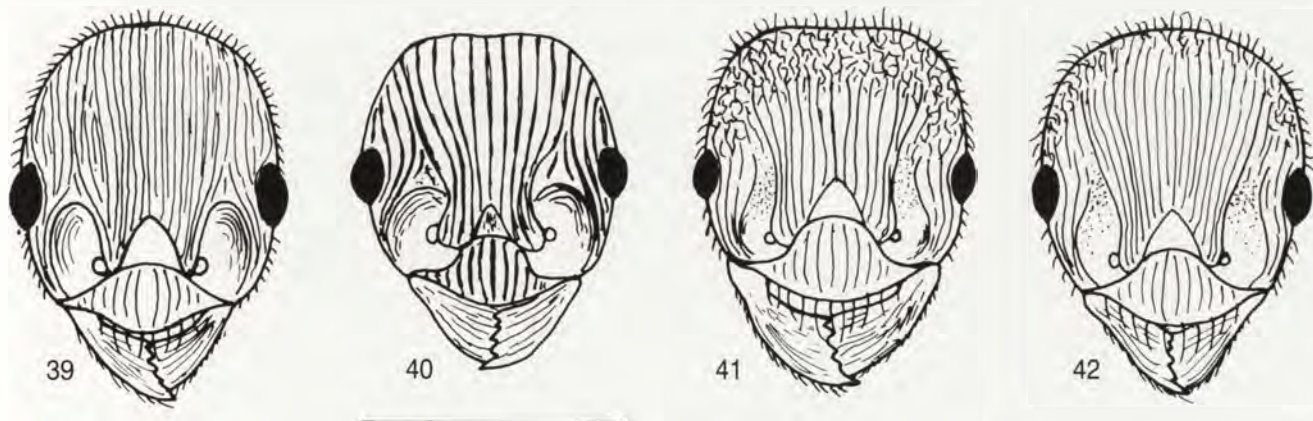


Figures 29–38. Worker antennal scape (a – lateral view, b – dorsal view; scale: 1 mm). (29) *M. rubra*; (30) *M. lobicornis*; (31) *M. sulcinodis*; (32) *M. gallieni*; (33) *M. rugulosa*; (34) *M. hellenica*; (35) *M. tonae*; (36) *M. sabuleti*; (37) *M. scabrinodis*; (38) *M. specioides* (paralectotype).

smooth or only with superficial sculpture, not coarsely rugulose; propodeal spines short (Fig. 43)

- ..... *M. rubra* L.
- Petiolar node not rounded at the top, with a distinct horizontal plate; nodes of petiole and postpetiole coarsely rugulose; propodeal spines long (Fig. 44) ..... *M. ruginodis* Nyl.
- 3 Antennal scape angulate at base and with a vertical lobe or at least dent (Fig. 30) ..... 4
- Antennal scape at base of different shape, always without a vertical lobe or dent (Figs 31–38) ..... 5
- 4 Petiole with a very short peduncle, its frontal surface steep, slightly convex and connected with the dorsal surface at a right or even acute angle (Fig. 45) ..... *M. lobicornis* Nyl.
- Petiole with a well developed peduncle, its frontal surface not steep, strongly convex and connected with the dorsal surface at a blunt angle (Fig. 46) ..... *M. schencki* Em.

- 5 Antennal sockets surrounded by rugae, which join the frontal carinae near the upper third of their length (Fig. 40). Antennal scape strongly curved at base, but without an angle or horizontal carina (Fig. 31). Alitrunk, petiolar and postpetiolar nodes with very coarse longitudinal rugae (Fig. 51). Frontal surface of postpetiole straight and steep, connected with the dorsal surface at a right angle (Fig. 51) ..... *M. sulcinodis* Nyl.
- Antennal sockets not surrounded by rugae (Figs 41, 42). Antennal scape strongly curved at base, without an angle, or angulate, with a horizontal lobe or carina (Figs 32–38) ..... 6
- 6 Petiole very broad, wider than high, PPI > 0.56 (Fig. 49). Whole body with very numerous long erect hairs ..... *M. hirsuta* Elmes.
- Petiole not wide, PPI < 0.50 (Fig. 50). Erect pilosity on body less abundant ..... 7

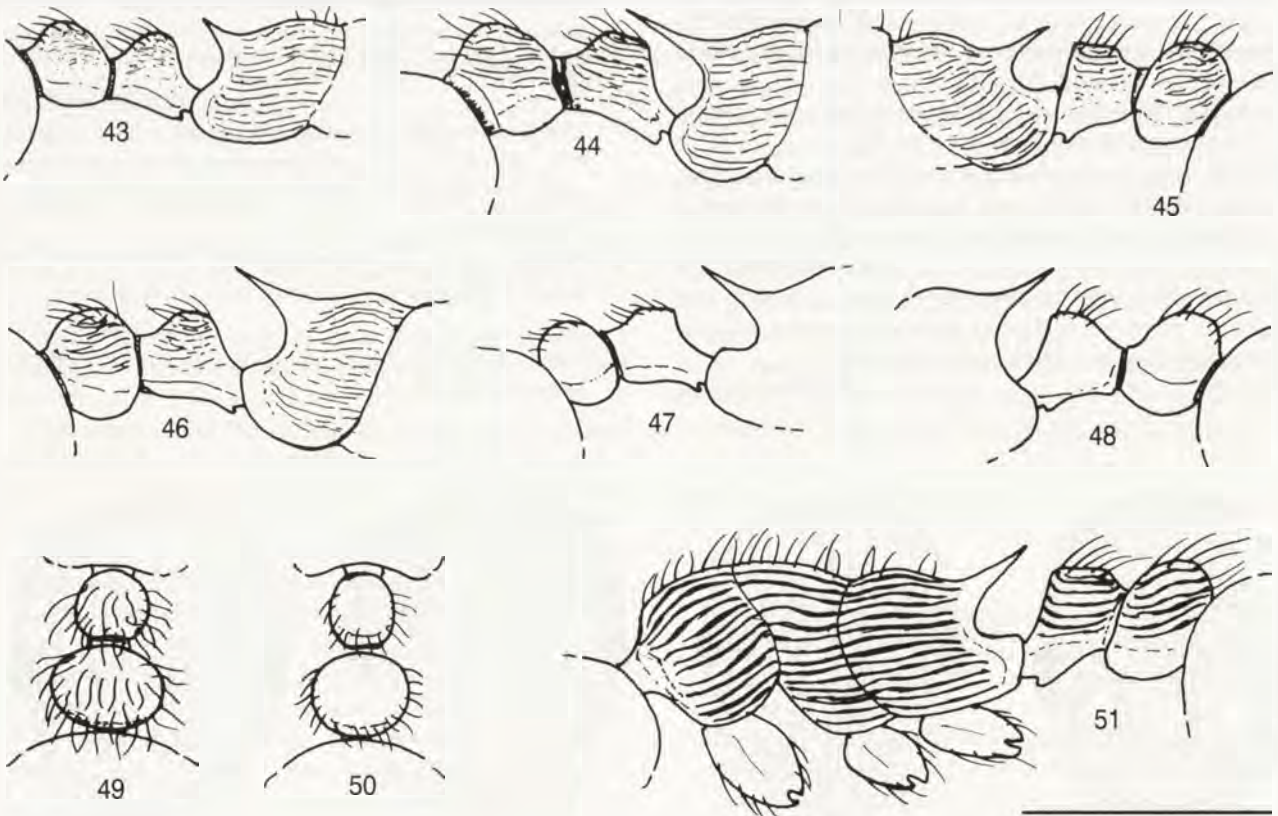


Figures 39–42. Worker head (frontal view; scale: 1 mm). (39) *M. rubra*; (40) *M. sulcinodis*; (41) *M. rugulosa*; (42) *M. gallieni*.

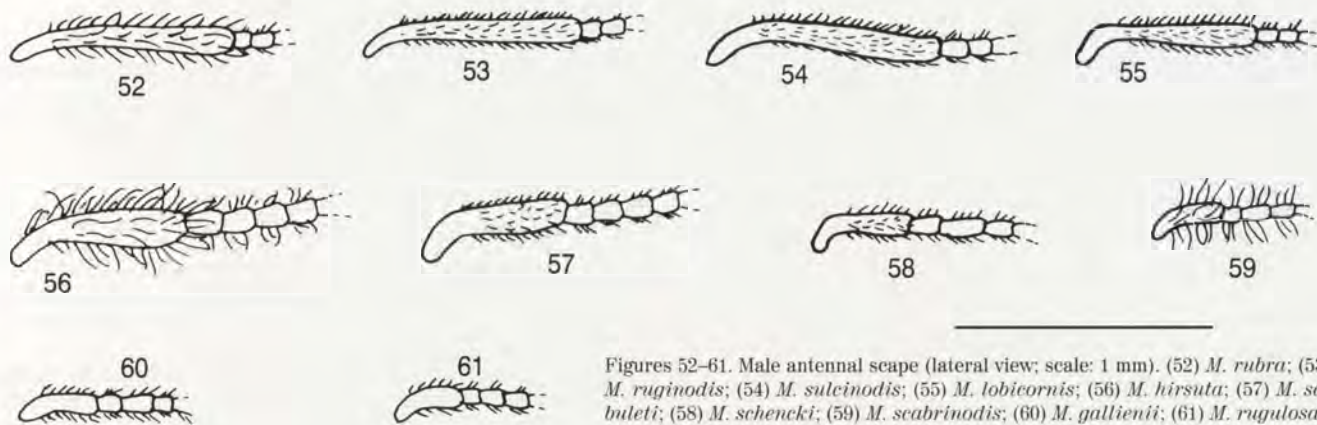
- 7 Antennal scape curved at base, without a distinct angle and horizontal lobe or carina (Figs 32 and 33) . . . . . 8
- Antennal scape clearly angulate at base, with a horizontal lobe or carina (Figs 34–38) . . . . . 9
- 8 Antennal scape at base bent in an ideal curve (Fig. 32). Head longitudinally rugulose, reticulate sculpture present only between the occiput and eyes (Fig. 42) . . . . . *M. gallienii* Bondr.
- Antennal scape at base sharply curved, slightly angulate (Fig. 33). Frons and cheeks longitudinally rugulose, the upper third of head with reticulate sculpture (Fig. 41) . . . . . *M. rugulosa* Nyl.
- 9 Antennal scape at base with a weak carina (Fig. 34). Frontal lobes slightly curved, frons wider: FLI=1.10–1.45, FI=2.14–2.30 . . . . . *M. hellenica* For.
- Antennal scape at base with a large or at least narrow lobe (Figs 35–38). Frontal lobes more strongly curved, frons narrower: FLI=1.20–1.86, FI=2.60–3.50 . . . . . 10
- 10 Antennal scape at base with a large, sometimes very massive lobe (Figs 35 and 36). Frontal lobes strongly curved, frons narrower: FLI=1.59–1.86, FI=3.04–3.50 . . . . . 11
- Antennal scape at base with a small lobe or sometimes only with a carina (Figs 37 and 38). Frontal lobes less strongly curved, frons wider: FLI=1.18–1.68, FI=2.60–3.21 . . . . . 12
- 11 Antennal scape at base with a very large, massive lobe (Fig. 35b) (SWI=4.92–6.00), clearly raised at scape level (seen in profile, Fig. 35a) (SHI=2.77–3.41) . . . . . *M. lonae* Finzi.
- Antennal scape at base with a smaller and not massive lobe (Fig. 36b) (SWI=6.00–8.28), not raised at scape level (seen in profile, Fig. 36a) (SHI=3.50–4.57) . . . . . *M. sabuleti* Mein.
- 12 Petiole with a distinct, sharp horizontal dorsal plate; its posterior face abruptly falls to the postpetiole (Fig. 47). Antennal scape at base with a wider lobe (Fig. 37) . . . . . *M. scabrinodis* Nyl.
- Petiole without a distinct horizontal dorsal plate; its posterior face smoothly falls to the postpetiole (Fig. 48). Antennal scape at base with a narrower lobe or even carina (Fig. 38) . . . . . *M. specioides* Bondr.

### Males

- 1 Antennal scape longer and slenderer; SI>0.68 (Figs 52–55) . . . . . 2



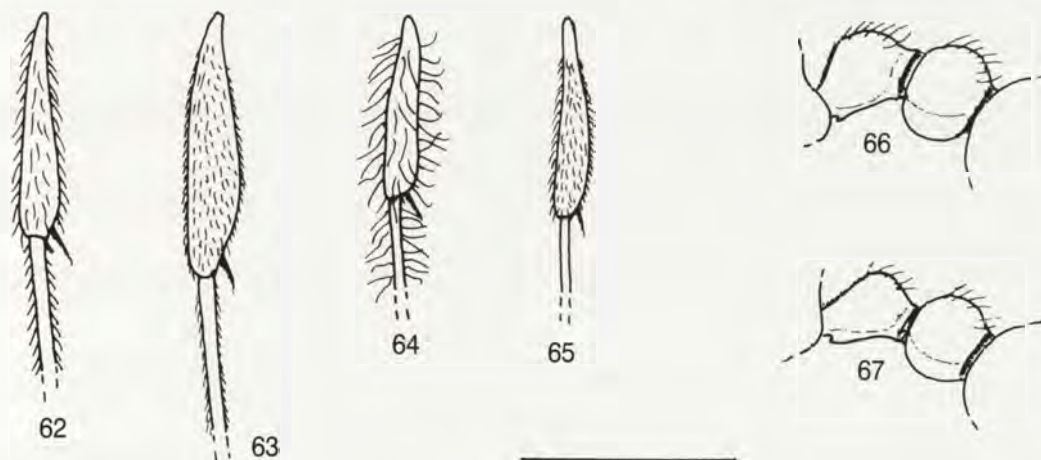
Figures 43–51. Worker propodeum, petiole and postpetiole (43–48 – lateral view; 49 and 50 – dorsal view; scale: 1 mm). (43) *M. rubra*; (44) *M. ruginodis*; (45) *M. lobicornis*; (46) *M. schencki*; (47) *M. scabrinodis*; (48) *M. specioides*; (49) *M. hirsuta*; (50) *M. sabuleti*. Worker alitrunk of *M. sulcinodis* (51; scale: 1 mm).



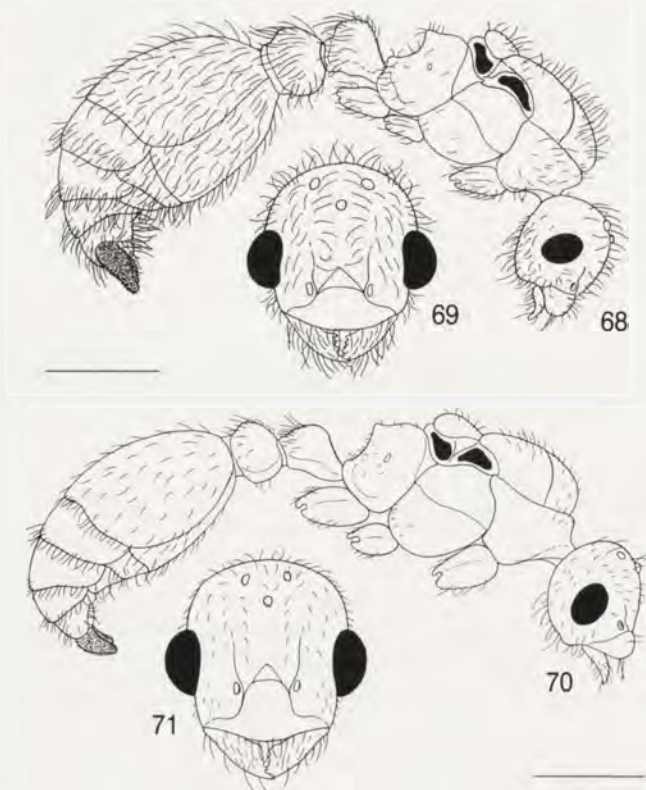
Figures 52–61. Male antennal scape (lateral view; scale: 1 mm). (52) *M. rubra*; (53) *M. ruginodis*; (54) *M. sulcinodis*; (55) *M. lobicornis*; (56) *M. hirsuta*; (57) *M. sabuleti*; (58) *M. schencki*; (59) *M. scabrinodis*; (60) *M. gallienii*; (61) *M. rugulosa*.

- Antennal scape shorter and thicker;  $SI < 0.66$  (Figs 56–61) . . . . . 5
- 2 Antennal scape weakly curved at base (Figs 52 and 53) . . . . . 3
- Antennal scape strongly curved at base (Figs 54 and 55) . . . . . 4
- 3 Antennal scape and tibiae with numerous long erect hairs (Figs 52 and 62) . . . . . *M. rubra* L.
- Antennal scape and tibiae with sparse short erect hairs (Figs 53 and 63) . . . . . *M. ruginodis* Nyl.
- 4 Antennal scape curved at base, but never angulate (Fig. 54). Petiole in profile low; its dorsal surface broadly rounded or even slightly flattened (Fig. 66) . . . . . *M. sulcinodis* Nyl.
- Antennal scape angulate at base (Fig. 55), but sometimes curved, as in *M. sulcinodis*. Petiole in profile higher; its anterior and dorsal surfaces meet in a weakly rounded angle (Fig. 67) . . . . . *M. lobicornis* Nyl.
- 5 Antennal scape relatively long; its length equal to length of 4–4.5 basal funicular joints together;  $SI > 0.50$  (Figs 56 and 57) . . . . . 6
- Antennal scape short; its length equal to the length of 3–3.5 of basal funicular joints together;  $SI < 0.45$  (Figs 58–61) . . . . . 7

- 6 Whole body with very numerous, long erect hairs; sides and occipital margin of head also with numerous, long erect hairs. The posterior surface of the petiole abruptly falls down before the junction with the postpetiole (Figs 68 and 69) . . . . . *M. hirsuta* Elmes.
- Whole body with much sparser and shorter erect hairs; sides and occipital margin of head with or without sparse, short erect hairs. The posterior surface of the petiole gradually falls down before the junction with the postpetiole (Figs 70 and 71) . . . . . *M. sabuleti* Mein., *M. lonae* Finzi.
- 7 Antennal scape clearly angulate at base (Fig. 58) . . . . . *M. schencki* Em.
- Antennal scape weakly curved at base (Figs 59–61) . . . . . 8
- 8 Antennal scape and legs with very long erect hairs (Figs 59 and 64) . . . . . *M. scabrinodis* Nyl.
- Antennal scape and legs with much shorter erect hairs (Figs 60, 61 and 65) . . . . . 9
- 9 Second funicular joint long, not less than 1.5 times longer than third (Fig. 60) . . . . . *M. gallienii* Bondr.
- Second funicular joint only slightly longer than third (Fig. 61) . . . . . *M. hellenica* For., *M. rugulosa* Nyl., *M. speciooides* Bondr.



Figures 62–67. Male hind tibiae (62–65; scale: 1 mm). (62) *M. rubra*; (63) *M. ruginodis*; (64) *M. scabrinodis*; (65) *M. rugulosa*. Male petiole and postpetiole (66 and 67; scale: 1 mm). (66) *M. sulcinodis*; (67) *M. lobicornis*.



Figures 68 and 69. *M. hirsuta*, male. (68) body, lateral view; (69) head, frontal view. (Scale: 1 mm).

Figures 70 and 71. *M. sabuleti*, male. (70) body, lateral view; (71) head, frontal view). (Scale: 1 mm).

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Table 1. Distribution of *Myrmica* species in particular geographical regions of Poland (see Figure 1): 1 – Baltic Coast, 2 – Pomeranian Lake District, 3 – Masurian Lake District, 4 – Wielkopolsko-Kujawska Lowland, 5 – Mazovian Lowland, 6 – Podlasie, 6a – Białowieża Forest, 7 – Lower Silesia, 8 – Upper Silesia, 9 – Krakowsko-Wieluńska Upland, 10 – Małopolska Upland, 10a – Świętokrzyskie Mts, 11 – Lubelska Upland, 12 – Roztocze, 13 – Sandomierska Lowland, 14 – Western Sudeten Mts, 15 – Eastern Sudeten Mts, 16 – Western Beskidy Mts, 17 – Eastern Beskidy Mts, 18 – Bieszczady Mts, 19 – Pieniny Mts, 20 – Tatra Mts (● – certain data, ○ – probable data, ? – questionable data)

No.	Species	Region																							
		1	2	3	4	5	6	6a	7	8	9	10	10a	11	12	13	14	15	16	17	18	19	20		
1	<i>Myrmica rubra</i> (L.)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
2	<i>Myrmica ruginodis</i> Nyl.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
3	<i>Myrmica sulcinodis</i> Nyl.					?								?	?		●		●			●		●	
4	<i>Myrmica lobicornis</i> Nyl.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●			●	●	●	
5	<i>Myrmica rugulosa</i> Nyl.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
6	<i>Myrmica gulieni</i> Bondr.	●	●		●	●	●	●				●		●	●										
7	<i>Myrmica hellenica</i> For.						●														●			●	
8	<i>Myrmica specoides</i> Bondr.					○				●		●		●		●			●				●		
9	<i>Myrmica scabrinodis</i> Nyl.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
10	<i>Myrmica sabuleti</i> Mein.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
11	<i>Myrmica lonae</i> Finzi							●				●		●		●								●	
12	<i>Myrmica hirsuta</i> Elmes																							●	
13	<i>Myrmica schencki</i> Viereck	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●



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